Macintosh Resources

Resources form the backbone of the Macintosh's consistent user interface. In this article, we describe these essential file elements, and show you how to customize them in order to make full use of the Macintosh's operating system.

UNKNOWN TO MOST Macintosh users, lurking within each file are file elements, called resources, which control much of the way the Mac works.

Among the large list of resource types are menus, windows, dialog boxes, alerts, icons, cursors, fonts, desk accessories, programming code, and layout information (see Table 1 for a list of the more common resources and their uses). Any of these can be altered to give the Macintosh Operating System a more personal feel, or to more accurately reflect the needs of the user.

Resource vs Data

Each Mac file has a Data Fork and/or a Resource Fork. The Data Fork is used by programs such as word processors to store the text of the document, or by graphics programs to store the information needed to draw the image. The Resource Fork contains any of the valid resource types for that file. An application program's resources are determined by the needs of the program itself; a data file's resource types are determined by the application which produced the file.

There are, in addition to the application-specific resources, generic resources used by most types of applications. For example, icons, menus, dialogs, alerts, and fonts are used by most applications to conform to the standard Macintosh Interface.

More than anything else, resources form the backbone of this consistent interface: applications access common resource types from the System File; menus look and work the same way across applications. Without resources, developers would have to code every facet of their programs' operations, rather than focus on the specific operations the program is to carry out.

There are approximately 120 commonly used resources, with numerous custom types used by applications. Each type of resource is assigned a 4-character name, which can include almost any of the 256 standard Macintosh characters. Each resource within a resource type has a unique ID, and can also have a name assigned.

Note: All resource names containing only lower-case letters are reserved by Apple for its own use. It is recommended that you do not use resource names which match existing resource names, regardless of differing case in the names (for example, you shouldn't use 'Font' as a resource name as there is already a resource type 'FONT'). All resource types *must contain* four characters – spaces can be used to pad the name to four characters.

ResEdit

Since the early days of the Macintosh, Apple has provided users with a program for creating and modifying resources. This program, ResEdit, went through several revisions before version 2.1 was distributed as the first official release version (previous versions were officially beta-test). Although primarily aimed at the developer market, ResEdit is widely available on bulletin boards and public domain lists. All references in this article refer to ResEdit Version 2.1 only.

ResEdit lets you open a file and carry out alterations to the resources within it. When a file is opened, a list of resource types (either in icon or list view) is presented. You can select either all the resources for cutting or copying, or you can double click on a particular resource type to show all available resources of that type. Once you have selected a particular resource type, you can cut, copy or paste any or all resources of that type. Double clicking on a particular resource will allow editing of that resource. File and folder attributes can also be changed with ResEdit.

The type of resource selected determines the editor which is called when the resource is opened. ResEdit has its own resource type, TMPL, which contains templates for a number of resource editors. If ResEdit does not have a template for the resource type opened, the user can either open it with the hexadecimal editor, or force ResEdit to open it using another template. You can create your own TMPL resources, or you can use program editors like the bit-map editors used extensively in ResEdit.

Using TMPLs means you don't need to decipher the esoteric hexadecimal listing of the bytes in a resource, and their use generally makes the editing of resources extremely easy.

ResEdit does not let you edit files currently in use (for example, you cannot edit the Finder when running under the MultiFinder), but it does allow the editing of system files.

Warning: Do all your editing on a copy of the original file. Working with ResEdit on original files can cause all sorts of damage and unpredictable results to your operating system.

Icons

Some of the most common resource types can be changed quite easily with ResEdit. This includes one of the most obvious aspects of the Macintosh interface: the icon.

Icons can be presented through the Finder (the Macintosh's file management system) or from within applications in dialogs and alerts. They are made up of a 32x32 (16x16 for small icons) pixel grid, and can be either monochrome, 4-bit color or 8-bit color. The color type used is determined on-the-fly by the Macintosh, so that the icons are displayed at the maximum possible quality.

Icons are grouped into several re-

source types:

- ICN# – monochrome 32x32 pixel icons;

- ics# – monochrome 16x16 pixel icons;

- icl4 – 4-bit color 32x32 pixel icons;

- ics4 – 4-bit color 16x16 pixel icons;

- icl8 – 8-bit color 32x32 pixel icons;

- ics8 – 8-bit color 16x16 pixel icons;

- ICON – monochrome 32x32 pixel icons (without mask).

Masks are used by all versions of icons, except ICONs, to determine which parts of the icons are to be transparent. Any dot on the mask makes the corresponding dot on the icon opaque, and masks are mainly used for stopping background patterns and colors from interfering with the image in the icon.

The mask can also be used to make the icon appear to change shape when it is selected, as the interaction between the mask and icon pixels is based on the Boolean OR operator. Although this can be very effective on white backgrounds, the results look rather unsatisfactory on patterned and colored backgrounds.

Icons can also be assigned to menu items to clarify their meaning. However, this looks strange when large icons are used and only some of the items have icons assigned to them – the spacing of the items then becomes highly irregular. Small icons (SICNs) can be assigned as well, giving more consistent spacing, although the icon image area is reduced.

Within ResEdit, icons of all types are edited via a consistent bit-map editor interface (see Figure 1). The various editors allow the user to carry out MacPaint-like operations on icons, including cut and paste.

You can, for example, screen-capture a particular 'scene', then copy a

```
actb    Alert Color Lookup Table
acur    Animated cursor resource
ADBS    ADB driver loaded before INIT 31
ALRT    Alert Template
APP⁄    Applicatio_ lis_ (Desktop)
atpl    AppleTalk Resource
bmap    BitMap
BNDL    Bundle
CACH    Ram Cache Control Code
cctb    Control Color Lookup Table
CDE⁄    Cod_ fo_ drawin_ controls
cicn    Color Icon
clut    Generic Color Lookup Table
CMDO    For MPW commando interface
cmnu    MacApp temporary menu resource
CNTL    Control Template
CODE    0 Jump Table
CODE    Application Code
crsr    Color Cursor
ctab    Cache Tab (list of possible cache sizes)
CTY#    City list from MAP CDEV
CURS    Cursor
dctb    Dialog Color Lookup Table
DICL    (for MacWorkstation)
DITL    Dialog Item List
DLOG    Dialog Template
DRVR    Driver
DSAT    Startup alerts & code to display them
FBTN    MiniFinder button
fctb    Font Color Lookup Table Types
FCMT    GetInfo comments from Desktop file
FDIR    MiniFinder button directory ID
finf    Font information
FKEY    Function Key Code
fld#    List of folder names for folder msg
FMTR    Format Record
FOBJ    Information about Folders
FOND    Font Family Description
FONT    Font Description
FREF    File Reference
FRSV    Rom Font resources
FWID    Font Width Table
gama    Gamma Table (color correction for screen)
GNRL    NBP Timeout and retry info for AppleTalk
ICON    Icon
ICN#    Icon List
ictb    Color dialog item list
INIT    Code that is run at system startup time
insc    Installer Script
INTL    0 International Formatting Information
        (replaces itl0; no longer used)
èitl0   International Formatting Information
INTL    1 International Date/Time Information
        (== itl1; no longer used)
itl1    International Date/Time Information
itl2    Intl Str Comparison Package Hooks
itl4    International Tokenize
itlb    International Script Bundle
itlc    International Configuration
itlk    Intl exception dictionary for kchar
KCAP    Physical Layout of Keyboard
```

Table 1. Common resource types

Macintosh Resources

```
KCHR     Ascii Mapping (software)
KEYC     old keyboard layout (used by old INIT 0+1)
KMAP     Keyboard Mapping (hardware)
kscn     Keyboard/Script icon
KSWP     Keyboard Swapping
LAYO     Finder layout resource
LDEF     Code for drawing lists
mach     CDEV filtering
MACS     Version # in system file
MBAR     Menu Bar
MBDF     Menu bar definition procedure (Code)
mcky     Mouse Tracking
mctb     Menu Color Lookup Table
mcod     MacroMaker information
mdct     MacroMaker information
MDEF     Code for drawing menus
mem!     MacApp memory utilization
MENU     Menu
minf     Macro info (MacroMaker)
mitq     Default queue sizes for MakeITable
mntb     MacApp menu table(relate command # to menu)
mppc     MPP Configuration Resource
NBPC     NBP configuration (AppleTalk)
ncts     List of constants
NFNT     Font Description
nrct     Rectangle position list
PACK     Packages of code used as Rom extensions
PAPA     Printer Access Protocol Address (AppleTalk)
PAT      Quickdraw Pattern
PAT#     Quickdraw Pattern List
PDEF     Code to drive printers
PICT     Quickdraw Picture
pltt     Color Palette
POST     Postscript - found in Laser Prep file
ppat     Pixel Pattern
ppt#     Array of ppats
PREC     Printer driver's private data storage
PRCO     Default page setup info for printer
         (PRED id = O)
PRC3     Print record (PREC id = 3)
PSAP     Just a string
PTCH     Rom Patch
qrsc     System 7.0 query resource
ROv#     Rom Resource Override
scrn     Screen Configuration
èseg!    MacApp
SERD     Ram serial driver
SICN     Small Icon
SIZE     MultiFinder Size Information
snd      Sound
STR      PascalStyle String
STR#     PascalStyle String List
styl     Style information for TextEdit
TEXT     Unlabeled string.(Same as minf)
tlst     Title list
TMPL     ResEdit template
vers     Application version information
wctb     Window Color Lookup Table
WDEF     Code for drawing windows
WIND     Window Template
wstr     Query str used by qrsc resource
```

Table 1. Common resource types (cont.)

portion of it from MacPaint into Res-Edit, rather than building the image up from scratch. If the copied image is larger than the icon size, it is centered on the icon area, and you are able to move the image to display the desired portion. Icons within the Finder can be changed to personalize the default application, file and folder icons. The Trash icon can also be changed, and some public domain variations include bat caves and toilets.

There are innumerable icons available through the public domain, with the most common being those for HyperCard and the Finder.

Cursors

Cursors, like icons, come in various guises, but rely on the same basic resource – CURS. This is an 8x8 pixel monochrome bit-map.

There are two types of cursor (or more accurately, two utilizations of the basic cursor resource type):

- CURS – monochrome 16x16 pixel 'run-of-the-mill' cursors;

- acur – a list of CURSs for use in animated cursors (the moving watch, for example).

Basically, cursors tell you the position of the screen pointer, as controlled by the mouse. They can be the normal arrow cursor, the watch cursor when time-consuming actions are taking place, or anything the developer chooses, such as I-beam cursors in word-processors. By using the acur resource type (Figure 2), you can specify a series of cursors to be displayed, one after the other. This can be used to achieve animations, the most common example being the watch cursor where the hands revolve around the face of the watch.

Cursors require one additional piece of information – their 'hot-spot'. The hot-spot is where the pointer actually is. In cross-hairs, for example, it is the intersection of the line making the cross hairs; on an arrow, the hot-spot is at the point of the arrow. The Macintosh considers the current mouse action to be occurring at the hot-spot, rather than over the whole
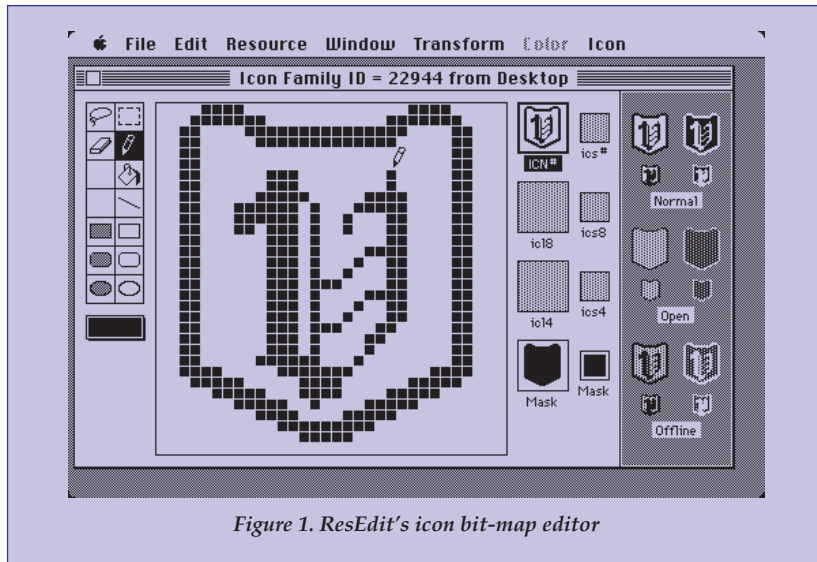
Figure 1. ResEdit's icon bit-map editor

cursor.

ResEdit allows the editing of cursors, including the hot-spot (Figure 3), in a bit-map editor which also displays the cursor against white, black and checkerboard backgrounds.

Cursors, like icons, have masks. It is highly advisable to make the mask a filled image of the cursor itself to ensure the cursor looks its best. The mask can extend beyond the edge of the cursor's image, as in the Macintosh's normal arrow cursor where this technique allows a border to appear on the arrow when it is placed on black pixels in the background.

Cursor Animator, from Wilhelm Plotz, is a Control Panel Device (CDEV) which lets you replace any system cursor with one of the many supplied animated or static cursors.

Fonts

An important concept with the Macintosh interface is 'what you see is what you get' (Wysiwyg). With Wysiwyg, the screen display matches the printed output as closely as possible. This was originally achieved (before the laser printer) through the use of screen fonts, of the resource type (not surprisingly) FONT.

FONT resources are basically bit-mapped representations of the letters within a font, along with some formatting information. To achieve the 'high quality' printing option (almost

150 dots per inch), when printing 12 point text, the 24 point screen font (which is 72 dpi) is reduced 50 percent, while retaining all the bit-mapped information. This means that users generally have more fonts than they actually use, increasing system file size.

Users of laser printers need not worry about this: only one size of screen font need be installed. The exception to this rule is the range of printers which do not use outline font technology (Apple's Personal Laser-Writer SE, for example). For these printers, a screen font of four times

the required font size is read in to achieve resolutions approaching 300 dpi.

The FOND resource is used to store the name of each font family. Each font family has a unique ID between 0 and 255. A particular font size has the ID:

```
Font Family ID number * 128 + Font Size
```

This means that the screen font for New York 12 pt has an ID of:

```
2 * 128 + 12 = 268
(The New York font family ID is 2)
```

Apple has reserved ID numbers 0-127, leaving only 128 for the numerous other fonts available. This leads to the possibility of ID conflicts, which versions 3.8 and later of the Font/DA Mover have attempted to overcome. If ID conflicts still occur, you can use ResEdit to change the ID of the family and individual sizes.

As resources, FONTs are easily edited with a variety of utilities, including ResEdit. Once again, ResEdit presents the user with a MacPaint-like bit-map editor, with each letter edited separately (see Figure 4). You can also alter attributes such as letter height, baseline position and letter spacing with ResEdit.

If you wish, you can create a font from scratch, although generally it is easier to find a font similar to the one
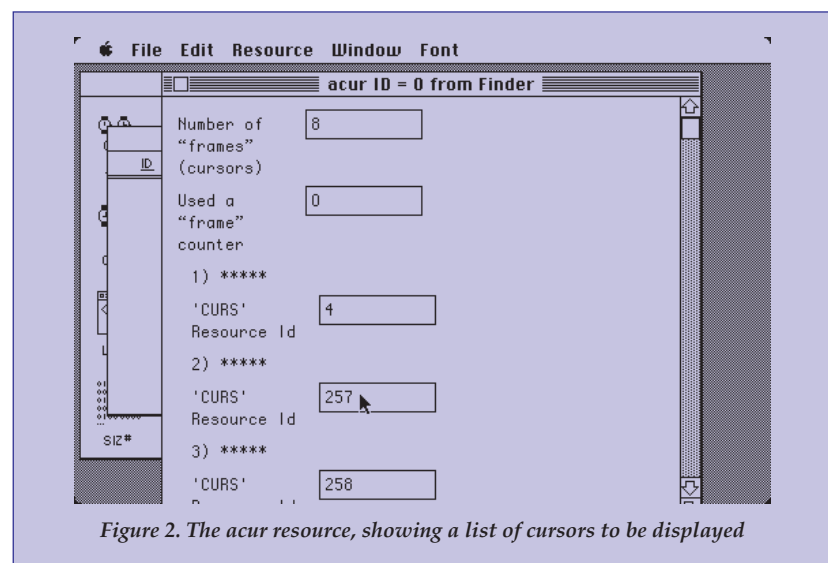

Figure 2. The acur resource, showing a list of cursors to be displayed

Macintosh Resources

required and then edit it to taste. Fonts are also available in the public domain and from commercial suppliers for a wide range of uses.

Menus

Menus are another important part of the Macintosh interface. As a resource, they are basically a list of items, with keyboard equivalents sometimes assigned to these items. When a menu item is chosen from within an application, the code of that application registers the choice and carries out the appropriate action. Unlike, say, the menuing system in Command Post (the utility for Microsoft Windows) which is a programming language in itself, the menus on the Macintosh are 'dumb', with the code determining the actions to be taken stored elsewhere in the file.

The Macintosh system automatically determines the minimum width for the menu items, and adds space for the keyboard equivalents. You can add separator lines – dotted lines which cannot be selected – to break a menu into groups of functions. Any character can be used in a menu, including spaces and punctuation marks.

One of the biggest complaints about menus is the lack of keyboard equivalents for menu items. You can add these menu shortcuts easily with ResEdit, along with color and text styl-
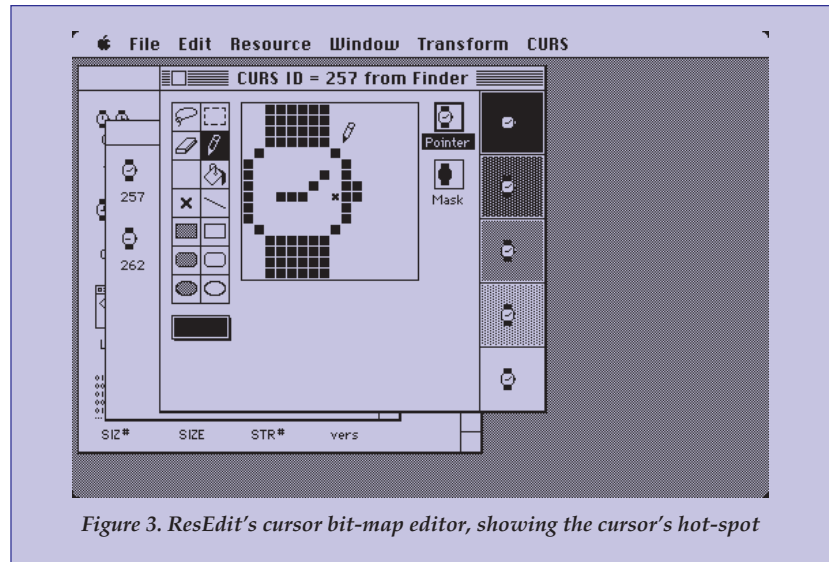

Figure 3. ResEdit's cursor bit-map editor, showing the cursor's hot-spot

ing information (Figure 5). You can also assign icons to menu items, and disable items if they are not available by default. When disabled, either by ResEdit or on the fly by an application, the item is grayed with a checkerboard pattern.

Finder Layout

A large amount of layout data for information displayed by the Finder is contained in the LAYO resource found within that file. The LAYO resource controls:

- The font ID and size of file names;

- The default dimensions of windows for folders and disks;

- Line spacing, page margins and column positions for file lists;

- Spacing details for icons;

- Whether an application window zooms from the icon size to the window size when a file or application is opened;

- Whether the system warns of program or system file deletes;

- Whether icons are constrained to the spacing grid when they are moved;

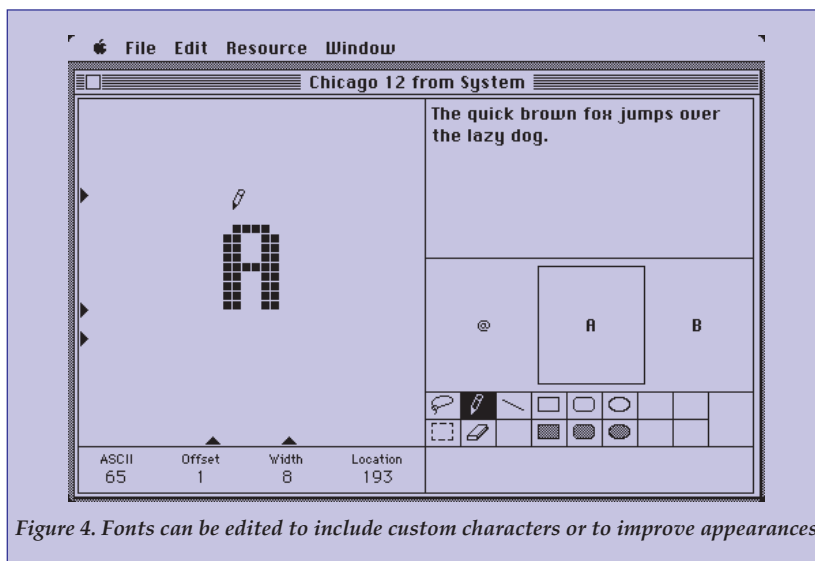- The maximum number of windows allowed to be open at any one time.

A particularly handy group of options within the LAYO resource deal with icon spacing. By setting the 'Icon vertical phase' to a number around 20-30 you can offset adjacent columns by this amount, thus reducing the incidence of file names running into adjacent files' icons (see Figure 6). Icons can be placed closer together vertically or horizontally as well. When

Figure 4. Fonts can be edited to include custom characters or to improve appearances

used in conjunction with the 'Always grid drags' option, this ensures the windows presented by the Finder remain neat and legible.

International Settings

Individual countries have different standards for the way dates, numbers and measurements are displayed. Many users also have personal preferences. Rather than using a '/' to separate date items, you may prefer to use '-' in order to avoid misreading the '/' as a '1'. The order used in displaying dates (such as M/D/Y or D/M/Y, amongst others) can also be a personal preference. For example, a journalist in England who constantly writes articles for the U.S.A. may want to use the U.S. options as the default.

All of this information, together with a host of further information such as the names of days of the week and months, is stored in the INTL, itl0 and itl1 resources (see Figure 7). The standard settings for a country can be selected from a wide range, and then altered to the user's needs. The INTL resource with id=0 is, in fact, the same as the itl0 resource, and the INTL resource with id=1 is the same as the itl1 resource. Most country settings are selected by choosing a country from a list, and then you can further customize any of the other standards for a particular country with ResEdit.
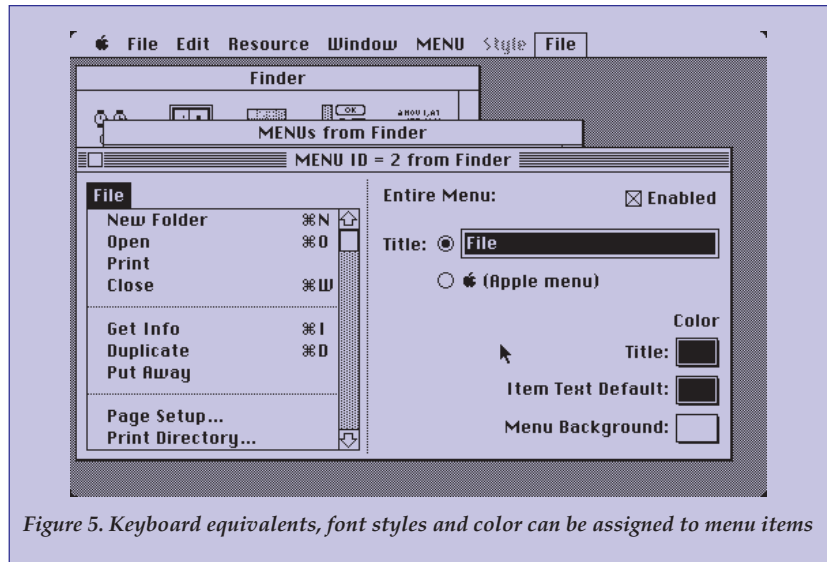

Figure 5. Keyboard equivalents, font styles and color can be assigned to menu items

Dialogs and Alerts

Dialogs and Alerts are used whenever the user is required to change a setting in a program, or if the system needs to inform the user of important information (system crashes and the like). For obtaining information from users, dialogs (resource type DLOG) are used; for merely informing the user of an occurrence, alerts (resource type ALRT) are used.

Dialogs and alerts are made up of buttons, check items, icons, pictures, text blocks (static and editable), window type, size and position informa-

tion. These are stored in the DITL (dialog item list) resource type, which is called when a dialog or alert is called. Program data can be included in the text blocks, and will be displayed when the dialog is called.

For dialogs and alerts, ResEdit presents a MacDraw-type editor (Figure 8) and allows the aligning of objects to the grid or to each other. You can create, add and modify individual items, and you can also move items in front of or behind other items if they overlap. Every time an item is moved forward or back, its number in the DITL also changes to reflect its 'depth'. The DITL editor is shown in Figure 9.
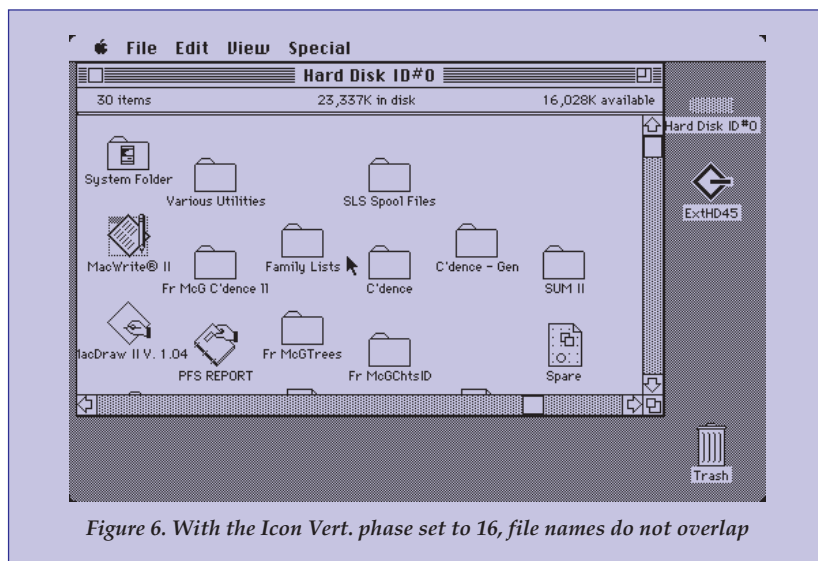
BNDLs and FREFs

When an application needs to perform a file operation, or when it is first loaded into the Finder, the Finder looks for a series of resources called BNDL and FREF and copies them into the Desktop file. BNDL and FREF control the file-type and creator attributes – four-character variables, usually invisible to the user. The creator indicates the application which created a particular file. These resources also tell the Finder the icons to use with each particular combination of file-type and creator the appli cation may create.

For example, Teach Text text files have a file-type of TEXT and a creator

Figure 6. With the Icon Vert. phase set to 16, file names do not overlap
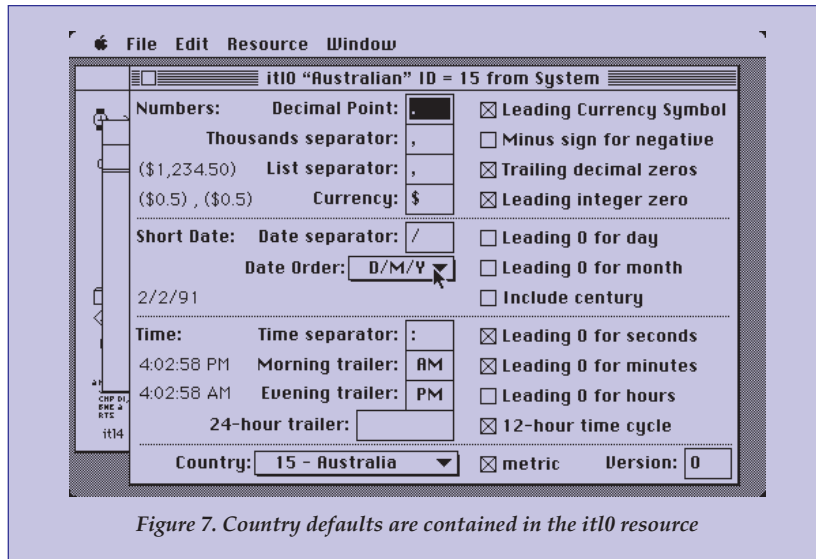
Macintosh Resources

Figure 7. Country defaults are contained in the itl0 resource

of ttxt, while Microsoft Word text files have the same file-type and a creator of MSWD. The use of the file-type and creator attributes allows the file to be opened by the application which created it by simply double-clicking on it, while other applications may be able to read the file-type, even if they were not the creator. In the latter case, you load your applications program and then try to open the file, instead of double-clicking on the file. If the file-type is readable by your application, the file will then be opened.

So, BNDLs and FREFs tell the Finder the relationships between applications, their specific data files, and the icons used to represent both. The BNDL editor of ResEdit lets you bundle the various pieces of information required by a BNDL resource with a graphic representation of the resources used.

Sounds

The Macintosh interface now allows the inclusion of sounds in files, as snd resources. Sound resources are a list of digitized sound information.

Although they cannot be edited with ResEdit (except as hexadecimal values), sound resources can be cut, copied or pasted between files, and they can also be played – at normal speed, at a series of pitches through a chord, or as a HyperCard sound. Sounds are usually handled differently

by HyperCard than by other applications, which is why a sound can be played as a HyperCard sound.

Patterns

If you want a personalized desktop, a background pattern can be chosen from a list of 32 presented in the Control Panel. These patterns, repeated (tiled) bit-maps of 8x8 pixels, are stored by the system as PAT# resources. They can be edited in a simple bit-map editor in ResEdit (Figure 10), and this editor's only function is to allow you to turn pixels on and off.

Each resource of type PAT# is, in fact, a list of 32 patterns, through which you can scroll. A representation of the pattern at normal size is also provided so you can get an idea of what the pattern will look like. These patterns are also used by HyperCard, MacPaint, and other Paint-type programs.

For scroll bars, opened icons and other system items, the patterns used are stored in PAT resources, which can be edited in a bit-map editor similar to that for PAT#s.

Strings

Applications will often require strings to be displayed to the user and, rather than hard-coding these into the program, the STR# resource type is often used. Using the STR# resource allows a list of strings to be stored in one place, which makes, for example, translating to a foreign language easier.

An example of a STR# is found in the Finder: this STR# carries information such as the names of items like the Trash, the text to be added to a file's name when it is duplicated (to avoid name conflicts), and so on. The STR# resource contains the list of strings to be used, and the calling program accesses these strings by requesting the required string by its position in the resource. Individual strings can also be stored in the STR resource type.
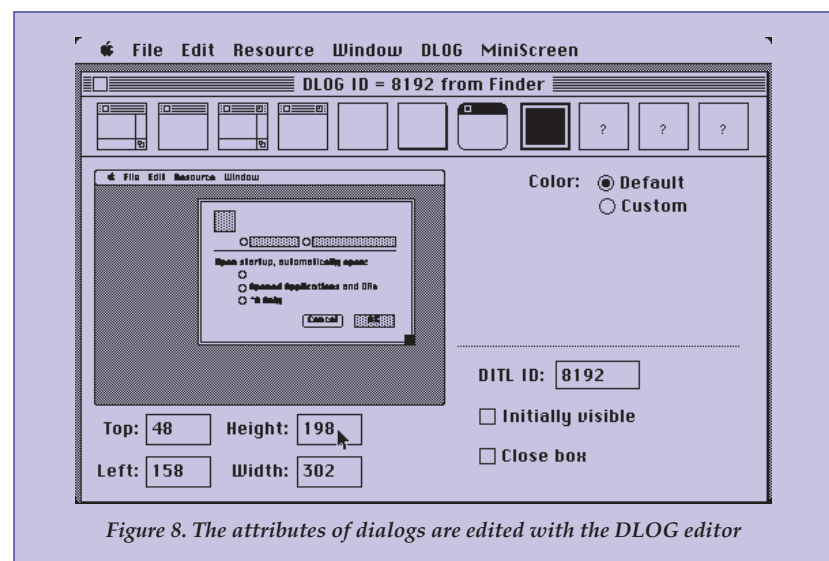

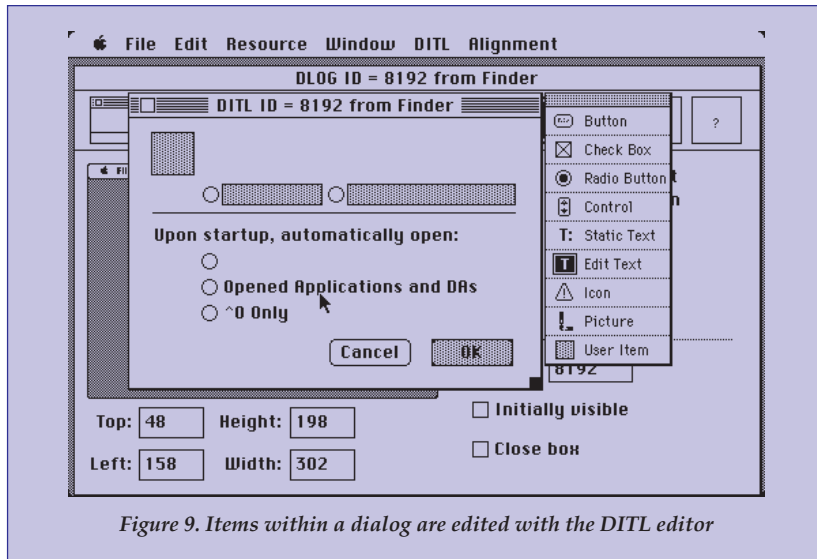*Figure 8. The attributes of dialogs are edited with the DLOG editor*

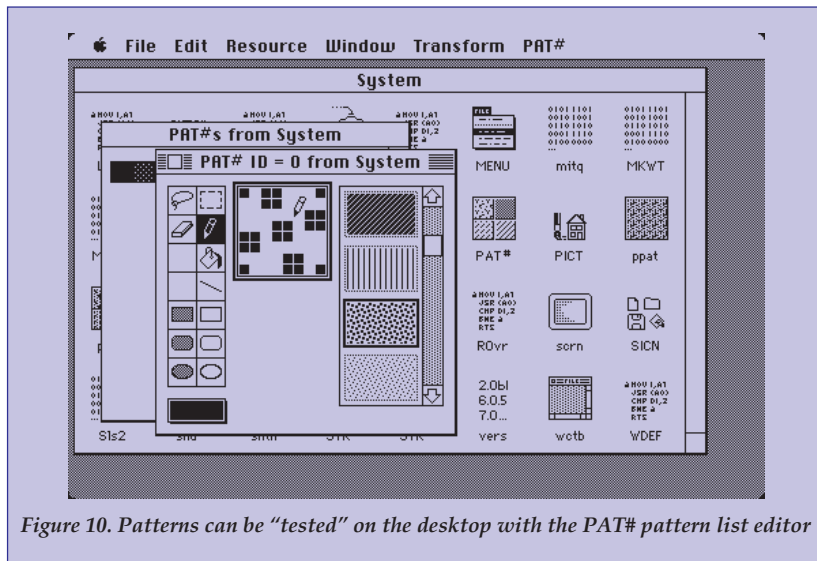*Figure 9. Items within a dialog are edited with the DITL editor*

Figure 10. Patterns can be "tested" on the desktop with the PAT# pattern list editor

Warning: Resources are an essential part of the way the Macintosh works. Changes to program files, and particularly system files, can result in system crashes.

It is recommended that a boot disk be prepared before carrying out changes with ResEdit.

To avoid damage to your system and program files, please ensure any changes are carried out on copies of files only, never on the originals. Even if the altered file continues to work as before, keeping the original file is an added level of security in case uncommon operations cause the system to crash. All users should ensure they understand the changes they are making before going ahead with those changes.

It is recommended that a boot disk be prepared before carrying out changes with ResEdit.

Windows Users

Many of the topics discussed in this article also apply to aspects of Windows 3.0 in the IBM PC compatible environment, although there is not a widely available editor for these elements for Windows.

One editor Windows users may consider using is Icondraw, from Philip Eskelin. When used in conjunction with PBIcon (from Impact Software) and Microsoft Paintbrush, Icondraw provides similar functions to ResEdit's icon drawing capabilities. Both IconDraw and PBIcon are shareware.

Where to get ResEdit 2.1

ResEdit 2.1 is available on the PCSA bulletin board system as a MacBinary file along with ResEdit Primer, a handy introduction to resources and using ResEdit, and additional templates for ResEdit to open and edit acur, SIZE CODE and snd resource types. Requests for the ResEdit 2.1 manual can be made through your local Apple Programmers and Developers Association office (APDA), or through bookstores.

PCSA

APDA Addresses

U.S.
Apple Computer
20525 Mariani Avenue, M/S 33-G
Cupertino, CA 95014-6299
Ph: 1-800-282 2732 (U.S.)
    1-800-637 0029 (Canada)
    1-408-562 3910 (International)

U.K.:
Apple Computer Ireland
Warrington House
Mount Street Crescent
Dublin 2
Ph: 353-1-604233 (International)

Australia:
Apple Computer Australia
16 Rodborough Rd
Frenchs Forest NSW 2086
Ph: 61-2-452 8213 (International)